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(54) Robotised pool cleaner

(57) A remotely controlled device for cleaning swimming pools, basins and similar (10) comprises a self-propelled cleaner (1) adapted to move over the surfaces (30) to be cleaned and a floating source of electrical power (11, 13) towed within the pool by said cleaner (1), said source comprising at least one battery (13) con-

nected by a tensile-resistant cable (17) to said self-propelled cleaner (1).

The floating source (11) comprises two half-shells (11A, 11B) and contains a central control unit (28) and control circuits (31, 32, 34) for the cleaner (1), while the multi-lead cable tensile-resistant (17) can carry both electrical power and information (Fig. 1).

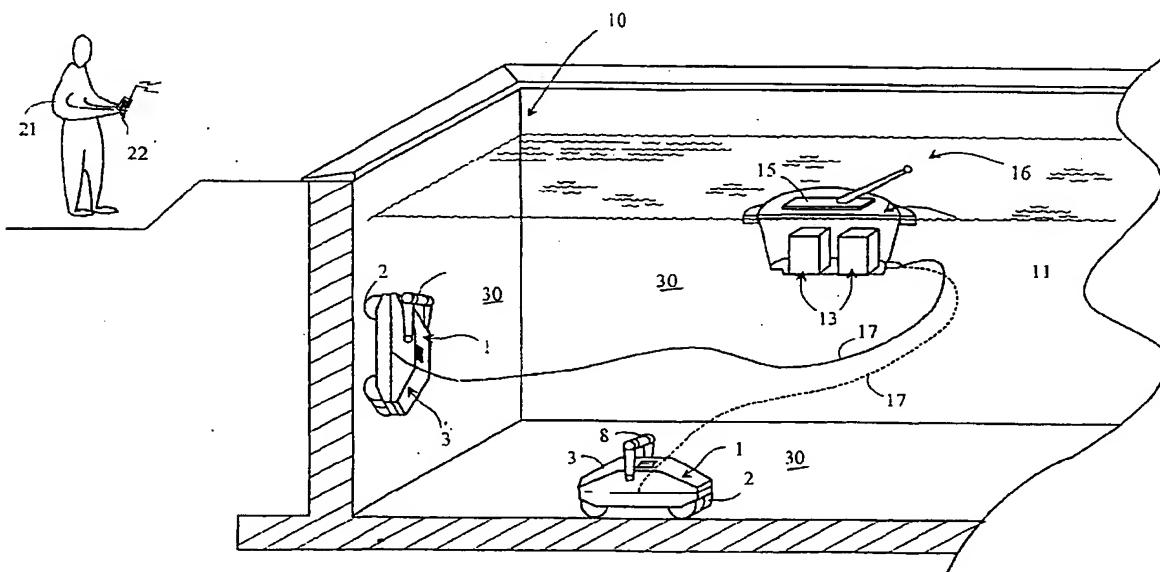


Fig. 1

Description

[0001] This invention generally relates to devices for cleaning swimming pools and/or basins, canalisations and the like, and more particularly is an object of the present invention to provide a remotely-controlled automatic pool cleaner powered by electrical batteries.

[0002] There are known several manually propelled pool cleaners such as those disclosed in US-A-3 979 788 and US-A-4 692 956, all equipped with a hose connected with a pressure or vacuum source.

There are further known completely automated (also called robotised) electric or electronic pool cleaners, that are either remotely controlled or properly programmed, but such devices need a cable to be connected to an electric power source, with such cable creating "umbilical" constraints to the device and hindering the movements thereof and increasing the costs and the weight to be carried.

[0003] From US-A-5842 243 there is known a manually-propelled pool cleaner i.e. a cleaner equipped with a long pole or rod used by the operator to manually move the apparatus in the swimming pool, provided with a buoyant case for housing a battery supplying electrical power to the cleaner pump with a simple cable connecting the floating case with the cleaner. A device of this design cannot operate along vertical walls or in swimming pools having sides much longer than the control pole, and moreover the floating housing can interfere with the propelling pole.

[0004] It is therefore an object of the present invention to overcome the above mentioned drawbacks and limitations of the prior art devices through an improved pool cleaner of the self-propelled and remotely-controlled type.

[0005] The invention achieves the above mentioned objects through a swimming pool cleaner as claimed in claim 1. Further advantageous features are recited in the dependent claims.

[0006] In accordance with the invention there is provided a floating housing connected to and towed by the pool cleaner, which contains the electrical supply batteries, the remote control receiver and an electronic unit such as a card for controlling the cleaner. The floating housing is connected to the cleaner by a short flexible and tensile resistant cable which supplies to this latter both the power for feeding the cleaning device and the control signals, if and when needed. In a presently preferred embodiment of the invention, the control circuits for the cleaner operations are located in the floating housing and the feeding cable comprises a plurality of conductors for carrying specific and suitably-timed feedings to the components of the self-propelled cleaner. This way the batteries can be easily maintained in a separate assembly from the body of the pool cleaner, thus obtaining assembly components of lower weight, that can be detached from one another and easily transported.

[0007] Since the cleaner does not need to be connected through an electric cable to a stationary point outside the pool, the pool cleaner in accordance with the invention can easily advance along channels and freely turn around pillars or floating "islands" in a swimming pool without any risk that the cable becomes entangled.

[0008] The invention will now be disclosed hereinbelow with reference to the attached drawings illustrating a nonlimiting embodiment thereof, in which:

Fig. 1 illustrates a schematic perspective and partially cross-sectioned view showing a cleaner according to the invention and illustrating its use; Fig. 2 is a partial cross-sectioned view of the floating housing or shuttle; and Fig. 3 is a block diagram illustrating an embodiment of the invention.

[0009] As illustrated in Figs. 1 and 3, a cleaner according to the invention comprises a self-propelled cleaning device 1 adapted to move over the surfaces 30 (both horizontal and vertical) of a swimming pool or basin 10 to be cleaned, a floating feeding source 11 inside which at least one battery 13 and a remote control signal receiver 15 are located, and a tensile-resistant cable 17 connecting the cleaning device with the power source 11. The system further comprises a remote control hand-held transmitter set 22 used by an operator 21 who moves along the edge of the swimming pool or basin. As illustrated later on in the description, the hand-held transmitter set 22 preferably includes also a receiver. In the following description, reference is made to a radio remote control system which is not to be understood as a limiting feature since the invention also applies to other types of remote control systems.

[0010] The self-propelled cleaner 1 comprises a case 3 equipped with a (transport) handle 8, the cleaner being provided with wheels 2, tracks or other motor-actuated locomotion means and housing cleaning devices such as pumps and/or brushes, the motor(s) for driving the wheels 2, and other components that are not illustrated in detail.

[0011] The cleaner 1 is adapted to climb the pool walls, to go forwards-backwards, to turn right and left hand in a swimming pool or basin 10 of any size, indicatively in 1 - 50 m long and 1 - 50 m wide swimming pools. In the illustrated embodiment, the cleaner is controlled by the radio control transmitter 22 held by an operator on the edge of the swimming pool, although in other embodiments a programmed control device can be simply started and stopped through the transmitter 22.

[0012] The cleaner is fed from the shuttle 11 which is a sort of floating "island" containing - in this embodiment - two batteries 13 and an electronic circuit 15 with a transmitter and a receiver.

[0013] The shuttle further houses an electronic control unit such as a card and a radio receiver which re-

ceives - through an aerial 16 - control signals or pulses transmitted by the operator. More precisely, with reference to the embodiment illustrated in Fig. 3, the floating housing 11 contains a central control unit 28, typically a programmed microcontroller, connected to a control unit 31 for the pump and a control unit 32 for the motors. These units are adapted to generate supply voltages of 24 V, respectively for the main pump and the right and left traction motors. A further control unit 34 is connected to the microcontroller 28 and generates control signals (at a lower voltage than the 24 V battery), such as the water surface and the inclination of the cleaner 1, that is its attitude in the horizontal-vertical plane.

[0014] The electrical conductors for carrying the above mentioned power supplies voltages and control signals are connected to a watertight connector 33 in which a mating connector joined to a multi-lead cable 17 is fitted.

[0015] The microcontroller 28 is further connected to a transmitter-receiver 35, an A/D 36 4-channel converter and a voltage regulator 37. The batteries 13 are of rechargeable type through a watertight connector 24 and, still inboard of the floating housing, a battery voltage regulator 39 is provided.

[0016] The small set 22 housing the remote control set (Figs. 1 and 3) incorporates a transmitter-receiver 40, for example operating at 433.92 MHz, a buzzer 41, and is further equipped with a display 42 and a matrix keyboard 43, by which the operator can enter the controls.

[0017] The electronic control card of the cleaner, located in the shuttle or service island 11, allows the automatic operation of the cleaner by executing one or more main cleaning programs either defined in advance in accordance with the basin size and/or shape and stored in the control units. Alternatively suitable control signals are transmitted by the operator through radio signals from the hand-held control set 22 (up to a distance of about 30 m).

[0018] With reference to the cross-section shown in Fig. 2, the construction of a preferred embodiment of the shuttle 11 is illustrated in detail.

[0019] The shuttle 11 comprises two half-shells 11A and 11B of a plastic material joined together along their peripheries provided with flanges 16A and 16B by turning the knobs of one or more screws 18 and with a seal gasket 19 being interposed between the flanges. The lower half-shell 11B has preferably a hydrodynamic profile in order to facilitate the shuttle displacement in the water and to prevent overloading the motors driving the cleaner. To the half-shell 11B there is further secured a peripherally extending member 25 of closed-cells spongy material having the dual function of buffering the shuttle and increasing its buoyancy.

[0020] On the shuttle top half-shell or cover 11B there is mounted a watertight connector 24 for connecting the batteries with a battery charger (not shown).

[0021] In an embodiment of the invention, not shown

in the drawings, the shuttle can be provided with a propeller driven by an electric motor to facilitate the navigation thereof, if this becomes necessary: e.g. when an excessive power is drawn by the motors actuating the cleaner wheels.

[0022] Thanks to a battery voltage regulator in the control unit 39 the battery can be used until discharged to a predetermined level, after which the control unit 39 stops the cleaning device and generates a warning signal for the operator (through the buzzer). This way the operator can take advantage of the residual electrical power to recover the cleaner from any point of the swimming pool where the cleaner has been stopped.

[0023] In addition to its function of troubleshooting indicator, the display 42 of the remote control set 22 can visualise the operations being carried out by the cleaner, and moreover it can act as a display terminal when the operator programs the cleaner functions. The remote control set can display signals indicating the exhaustion of the batteries, which situation can activate an audible alarm, too. The operating cycle(s) of cleaner is (are) programmable both in respect of the duration and of the type of work, with a predetermined plurality of possible paths and time durations depending on the size and shape of the pools.

[0024] Although the invention has been illustrated with reference to preferred embodiments thereof, the invention is generally susceptible of other applications and modifications falling within its scope, as will be evident to the skilled of the art. For example, a pair of supply conductors can be used for carrying the feeding voltages, and another pair of conductors can convey information about the way they are to be distributed through control and drive circuits housed within the self-propelled cleaner.

Claims

40. 1. A remotely controlled device for cleaning swimming pools, basins and the like, comprising:
 - a self-propelled cleaner (1) adapted to move over the surfaces (30) to be cleaned;
 - a source of electrical power (11, 13) comprising at least one battery (13) and connected by a cable (17) with said self-propelled cleaner (1);
 characterised in that said source of electrical power (11, 13) is floating and is towed inside the swimming pool by said cleaner (1) through said cable (17) which is tensile-resistant.
2. A device as claimed in claim 1, characterised in that said floating source of electrical power (11, 13) comprises a housing (11) containing at least one battery (13).

3. A device as claimed in claim 1 or 2, characterised in that it further comprises a remote control transmitter (22), and that said housing (11) contains a receiver (35) for said remote control transmitter (22), and an electronic unit or card controlling said cleaner (1). 5

4. A device as claimed in claim 3, characterised in that said housing (11) further contains a central control unit (28) and control circuits (31, 32, 34, 39) for said cleaner (1), one of said control circuit (39) including a voltage regulator adapted to stop the cleaning device and generate a warning signal when said battery has been discharged to a predetermined level. 10

5. A device as claimed in the preceding claims, characterised in that said tensile-resistant cable (17) is adapted for carrying both electrical power and information. 15

6. A device as claimed in claim 5, characterised in that said cable (17) contains conductors which carry voltages equal to the ones of said battery (13) and control signals for controlling the attitude of said cleaner, which signals are made up by voltages lower than the voltage of said battery (13). 20

7. A device as claimed in the preceding claims, characterised in that said floating housing (11) comprises two half-shells (11A, 11B) of plastic material that are joined together through screw (18) along their peripheries provided with flanges (16A, 16B) with an interposed sealing gasket (19). 25

8. A device as claimed in claim 7, characterised in that the lower of said half-shells has a hydrodynamic profile and carries a buffering peripheral element (25) of light material that increases the buoyancy of said housing (11). 30

9. A device as claimed in claim 7 or 8, characterised in that it further provides for a watertight connector (24) for the connection with a battery charger on the top half-shell (11B) and a watertight connector (33) for said feeding cable (17) on the top half-shell (11A). 35

10. A device as claimed in the preceding claims, characterised in that said self-propelled cleaner (1) can move on the horizontal and vertical surfaces. 40

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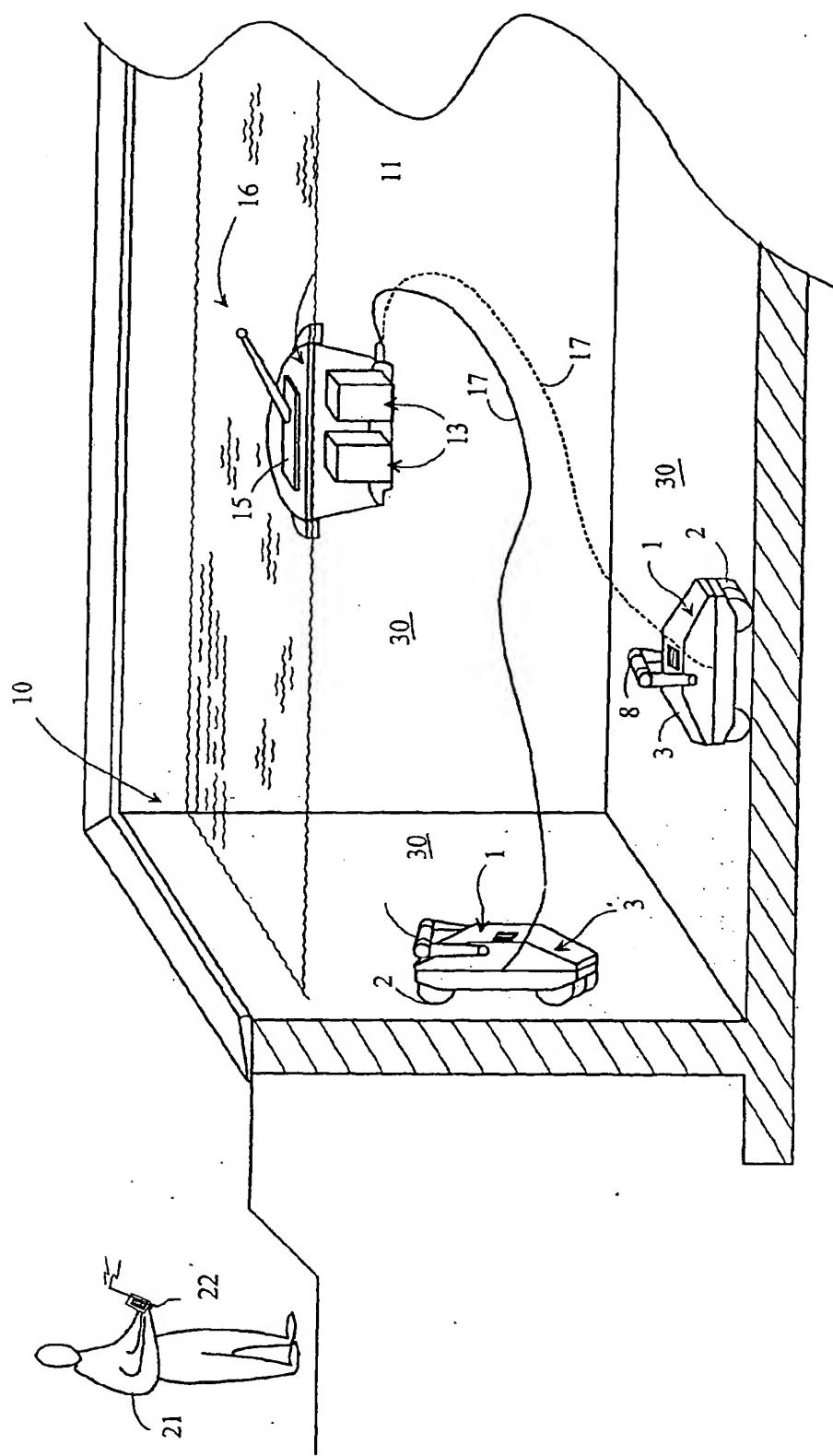


Fig. 1

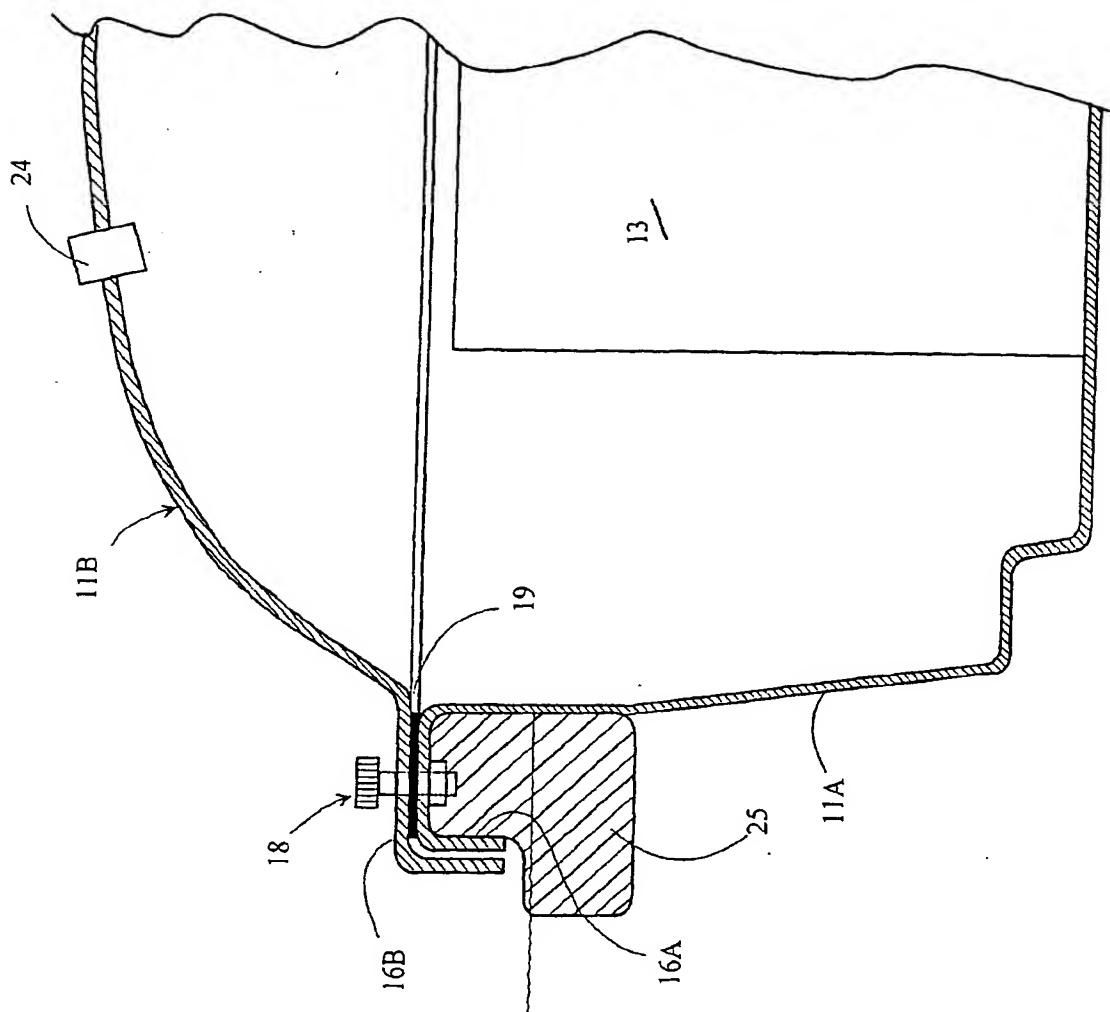
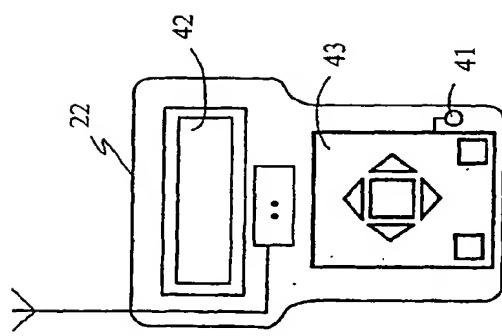
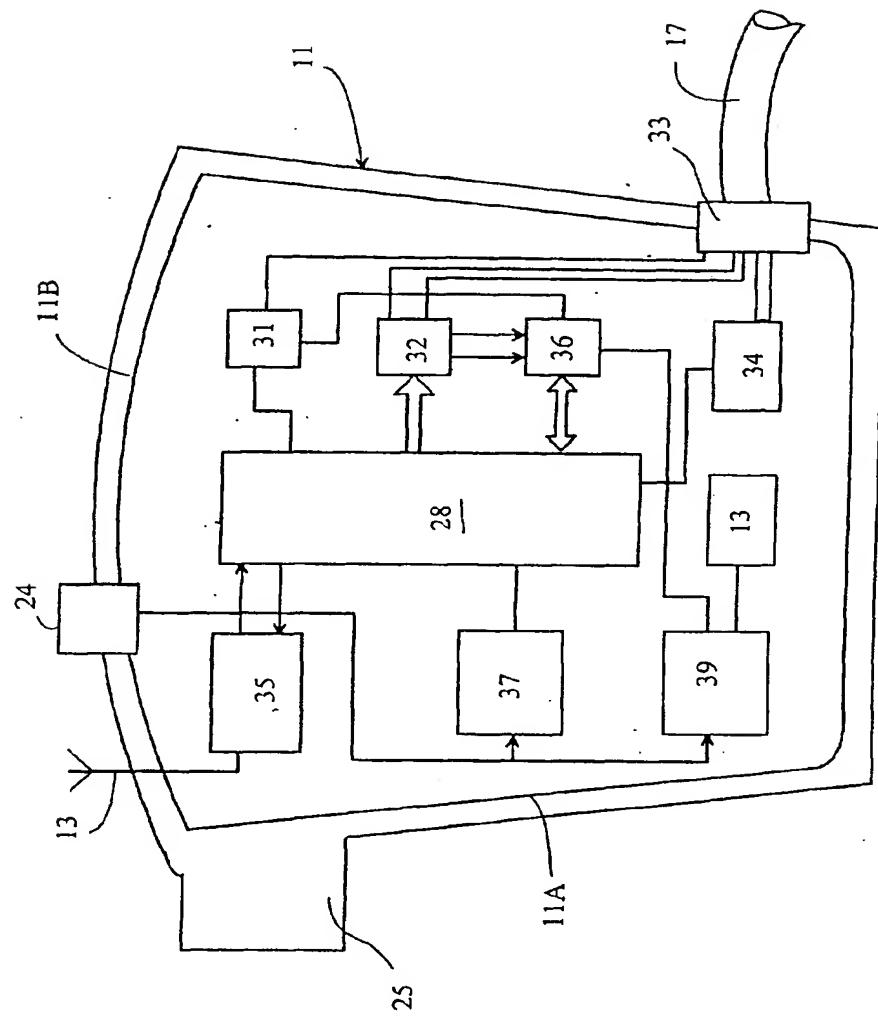


Fig. 2



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EUROPEAN SEARCH REPORT

Application Number
EP 01 10 1590

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D, Y	US 5 842 243 A (HORVATH TIBOR ET AL) 1 December 1998 (1998-12-01) * column 7, line 39 - line 65; figures * ---	1,2,5,7, 9,10	E04H4/16
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<p>The present search report has been drawn up for all claims</p>			
Place of search	Date of completion of the search	Examiner	
THE HAGUE	5 June 2001	Fordham, A	
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 01 10 1590

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